



- ☐ Tentative Specification
☐ Preliminary Specification
☒ Approval Specification

MODEL NO.: V216B1
SUFFIX: LE3

Customer:

APPROVED BY

SIGNATURE

Name / Title

Note

Please return 1 copy for your confirmation with your signature and comments.

| Approved By | Checked By | Prepared By |
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**REVISION HISTORY**

| Version | Date | Page(New) | Section | Description |
|----------|--------------|-----------|---------|-------------------------------------|
| Ver. 2.0 | Mar 15, 2012 | All | All | The specification was first issued. |

1. GENERAL DESCRIPTION

1.1 OVERVIEW

V216B1-LE3 is a 21.6" TFT Liquid Crystal Display module with LED Backlight unit and a 30pin 1ch-LVDS interface. This module supports 1366 x 768 (16:9 wide screen) formats and can display 16.7M colors (6-bit+FRC colors). The converter for backlight is not built-in.

1.2 FEATURES

- Excellent brightness (250 nits)
- Contrast ratio (1000:1)
- Fast response time (5 ms)
- Color saturation (NTSC 72%)
- 1366 x 768 pixels (16:9 wide screen) resolution
- DE (Data Enable) only mode
- LVDS (Low Voltage Differential Signaling) interface
- Viewing angle : 170(H)/160(V) (CR>10) TN technology
- RoHS compliance

1.3 APPLICATION

- Standard Living Room TVs
- MFM Application

1.4 GENERAL SPECIFICATIONS

| Item | Specification | Unit | Note |
|------------------------|--|-------|------|
| Active Area | 477.417(H) x 268.416 (V) (21.6" diagonal) | mm | (1) |
| Bezel Opening Area | 481.5 (H) x 272.5 (V) | mm | |
| Driver Element | a-si TFT active matrix | | |
| Pixel Number | 1366 x R.G.B. x 768 | pixel | |
| Pixel Pitch(Sub Pixel) | 0.1165 (H) x 0.3495 (V) | mm | |
| Pixel Arrangement | RGB vertical stripe | | |
| Display Colors | 16.7M | color | |
| Display Operation Mode | Transmissive mode / Normally white | | |
| Surface Treatment | Anti-Glare coating (Haze 25%), Hard coating(3H) | | |

Note (1) Please refer to the attached drawings in chapter 11 for more information about the front and back outlines.

**1.5 MECHANICAL SPECIFICATIONS**

| Item | | Min. | Typ. | Max. | Unit | Note |
|-------------|----------------|-------|------|-------|------|------|
| Module Size | Horizontal (H) | 500.5 | 501 | 501.5 | mm | (1) |
| | Vertical (V) | 296.5 | 297 | 297.5 | mm | (1) |
| | Depth (D) | 10.6 | 11.1 | 11.6 | mm | (2) |
| Weight | | — | 1970 | — | g | |

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

Note (2) Module Depth is between bezel to T-CON cover.

2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

| Item | Symbol | Value | | Unit | Note |
|-------------------------------|------------------|-------|------|------|---------|
| | | Min. | Max. | | |
| Storage Temperature | T _{ST} | -20 | +60 | °C | (1) |
| Operating Ambient Temperature | T _{OP} | 0 | 50 | °C | (1) (2) |
| Shock (Non-Operating) | S _{NOP} | — | 50 | G | (3) (5) |
| Vibration (Non-Operating) | V _{NOP} | — | 1.0 | G | (4) (5) |

Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. ($T_a \leq 40^\circ\text{C}$).

(b) Wet-bulb temperature should be 39 °C Max. ($T_a > 40^\circ\text{C}$).

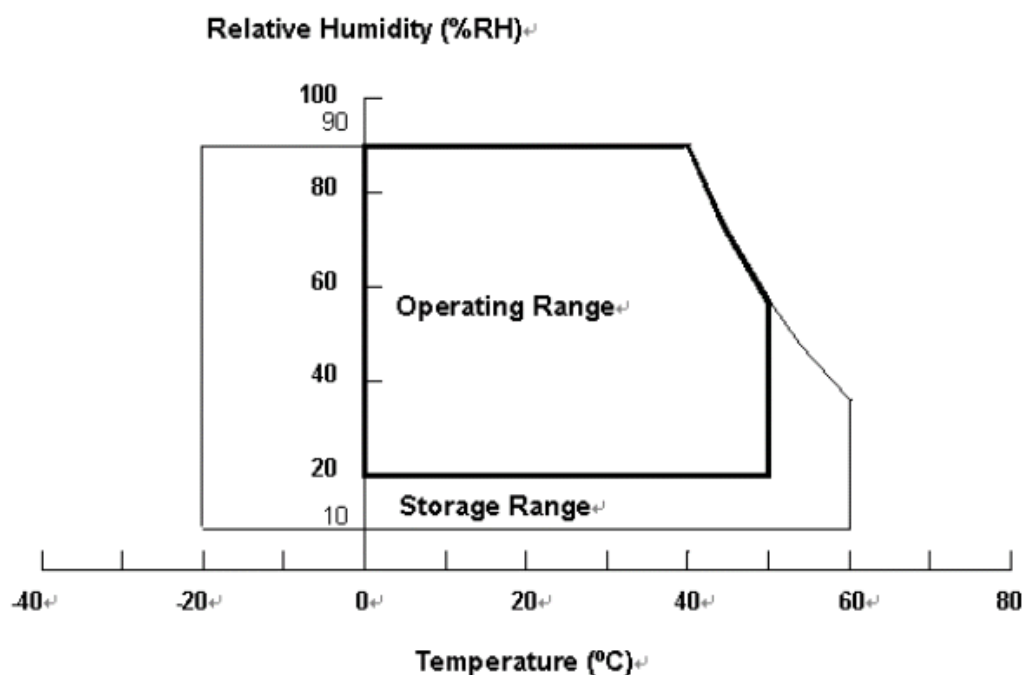
(c) No condensation.

Note (2) The maximum operating temperature is based on the test condition that the surface temperature of display area is less than or equal to 65 °C with LCD module alone in a temperature controlled chamber. Thermal management should be considered in final product design to prevent the surface temperature of display area from being over 65 °C. The range of operating temperature may degrade in case of improper thermal management in final product design.

Note (3) 11 ms, half sine wave, 1 time for $\pm X, \pm Y, \pm Z$.

Note (4) 10 ~ 200 Hz, 10 min, 1 time each X, Y, Z.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.



2.2 PACKAGE STORAGE

When storing modules as spares for a long time, the following precaution is necessary.

- (a) Do not leave the module in high temperature, and high humidity for a long time, it is highly recommended to store the module with temperature from 0 to 35 °C at normal humidity without condensation.
- (b) The module shall be stored in dark place. Do not store the TFT-LCD module in direct sunlight or fluorescent light.

2.3 ELECTRICAL ABSOLUTE RATINGS

2.3.1 TFT LCD MODULE

| Item | Symbol | Value | | Unit | Note |
|----------------------|-----------------|-------|------|------|------|
| | | Min. | Max. | | |
| Power Supply Voltage | V _{CC} | -0.3 | 6.0 | V | (1) |
| Logic Input Voltage | V _{IN} | -0.3 | 3.6 | V | |

2.3.2 BACKLIGHT CONVERTER UNIT

| Item | Symbol | Value | | | Unit | Note |
|---|-----------------|-------|------|------|------|---|
| | | Min. | Typ. | Max. | | |
| LED Forward Current Per Input Pin | I _F | 0 | 65 | 70 | mA | (1) (2) Duty=100% |
| LED Reverse Current Per Input Pin | I _R | — | — | 85 | mA | |
| LED Pulse Forward Current Per Input Pin | I _{FP} | — | — | 200 | mA | Pulse Width ≤ 10msec. and Duty ≤ 10% |

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for input pin of LED light bar at Ta=25±2 °C (Refer to 3.2 for further information).

3. ELECTRICAL CHARACTERISTICS

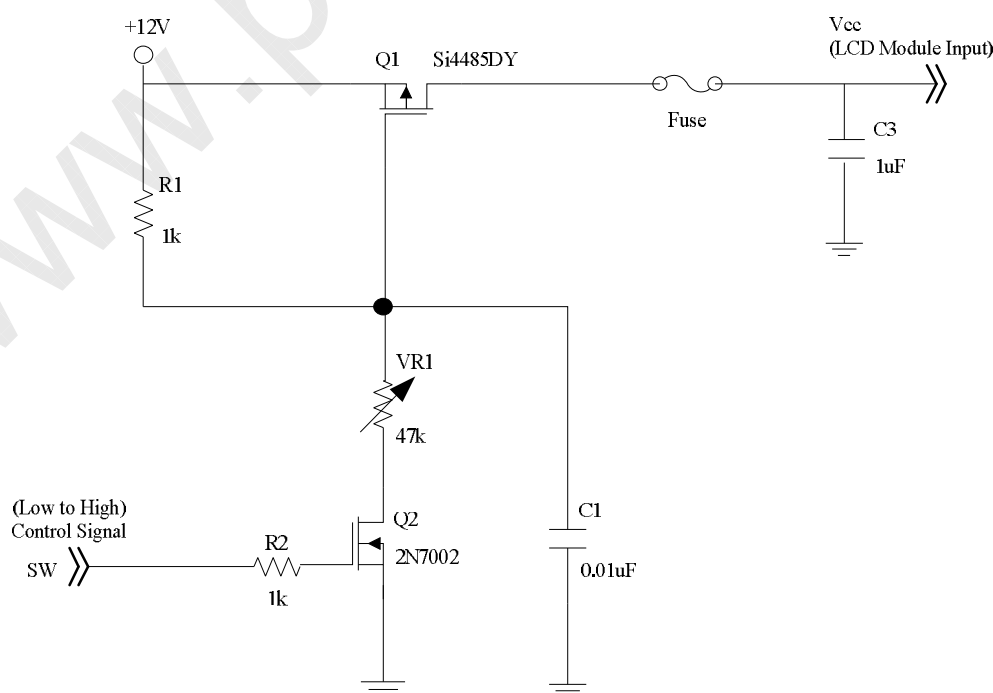
3.1 TFT LCD MODULE

(Ta = 25 ± 2 °C)

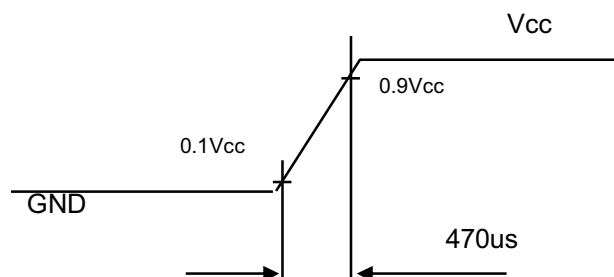
| Parameter | | Symbol | Value | | | Unit | Note |
|----------------------|---|-------------------|-------|------|-------|------|------|
| | | | Min. | Typ. | Max. | | |
| Power Supply Voltage | | V _{CC} | 4.5 | 5.0 | 5.5 | V | (1) |
| Rush Current | | I _{RUSH} | — | — | 3.0 | A | (2) |
| Power Supply Current | White | — | — | 0.24 | — | A | (3) |
| | Black | — | — | 0.37 | — | A | |
| | Horizontal Stripe | — | — | 0.42 | 0.483 | A | |
| LVDS interface | Differential Input High Threshold Voltage | V _{LVTH} | +100 | — | — | mV | (4) |
| | Differential Input Low Threshold Voltage | V _{LVTL} | — | — | -100 | mV | |
| | Common Input Voltage | V _{CM} | 1.0 | 1.2 | 1.4 | V | |
| | Differential input voltage (single-end) | V _{ID} | 200 | — | 600 | mV | |
| | Terminating Resistor | R _T | — | 100 | — | ohm | |
| CMOS interface | Input High Threshold Voltage | V _{IH} | 2.7 | — | 3.3 | V | |
| | Input Low Threshold Voltage | V _{IL} | 0 | — | 0.7 | V | |

Note (1) The module should be always operated within the above ranges.

Note (2) Measurement condition:

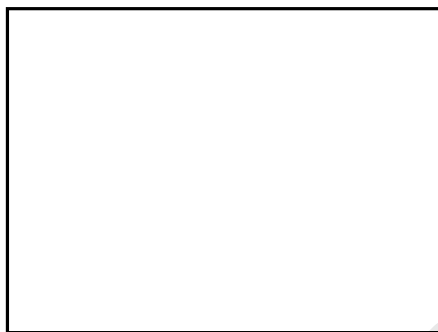


Vcc rising time is 470us



Note (3) The specified power supply current is under the conditions at $V_{cc} = 5\text{ V}$, $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$, $f_v = 60\text{ Hz}$, whereas a power dissipation check pattern below is displayed.

a. White Pattern



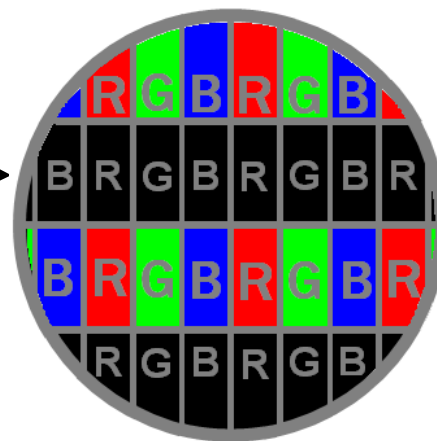
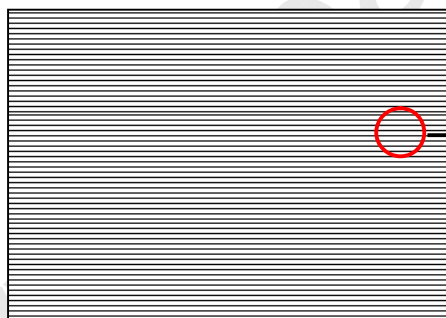
Active Area

b. Black Pattern

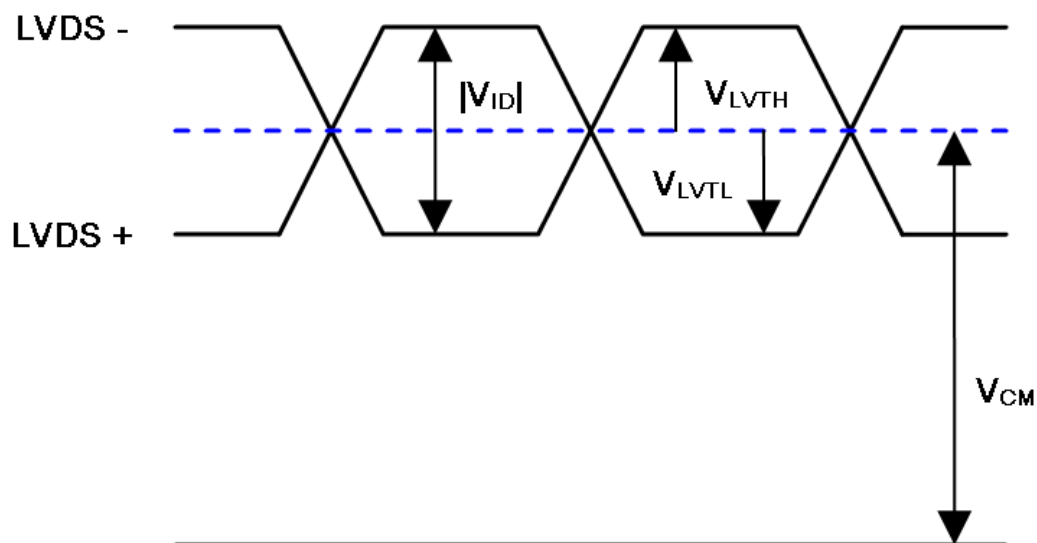


Active Area

c. Horizontal Pattern



Note (4) The LVDS input characteristics are as follows:



3.2 BACKLIGHT CONNECTOR PIN CONFIGURATION

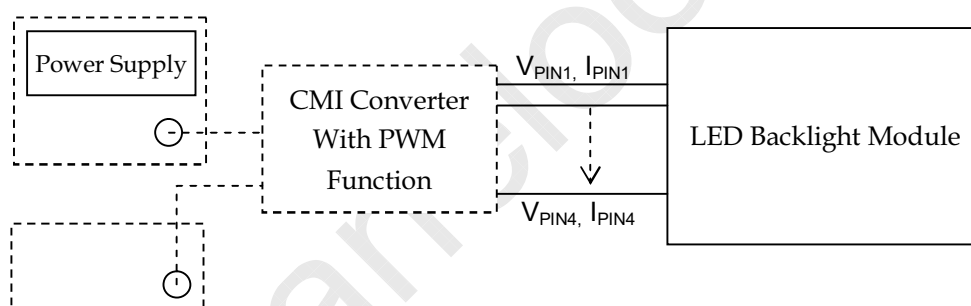
3.2.1 LED LIGHT BAR CHARACTERISTICS (Ta=25±2℃)

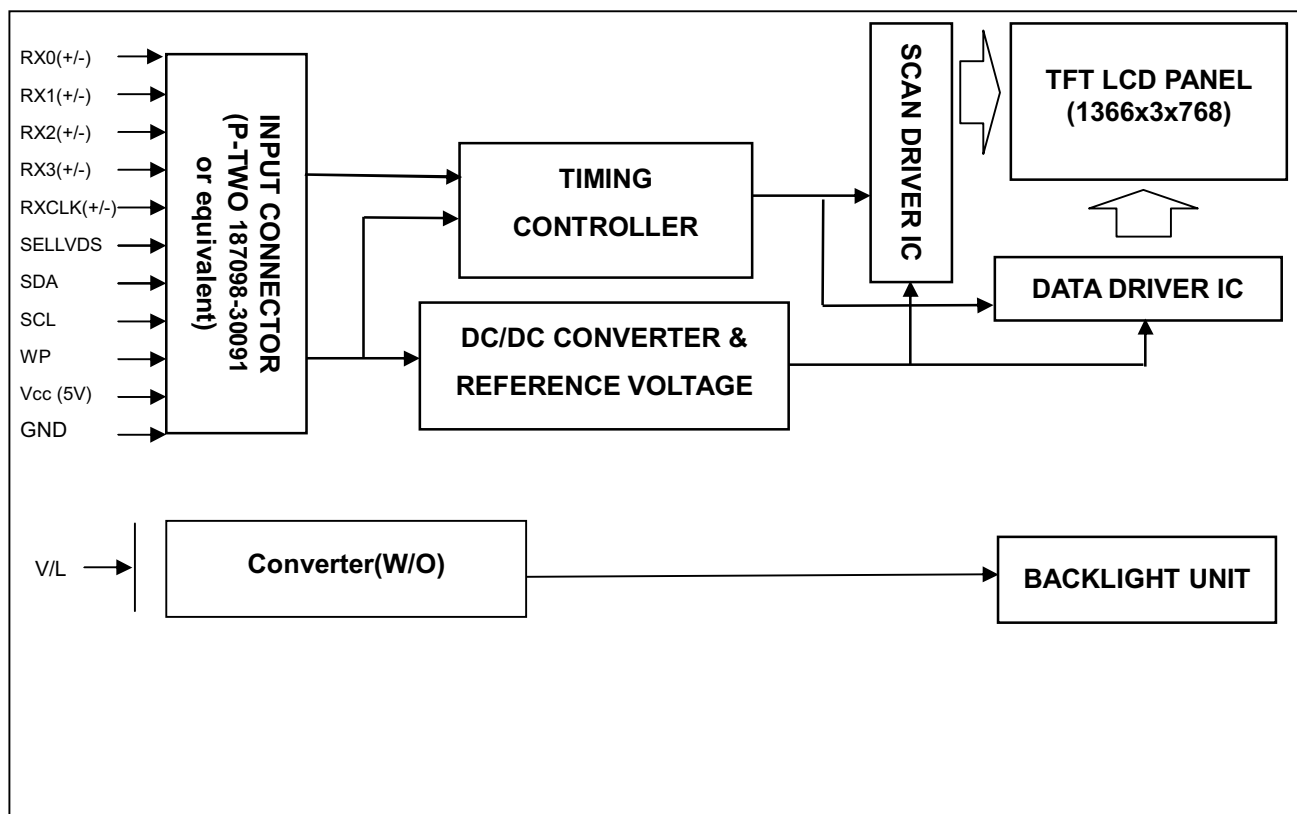
| Parameter | Symbol | Value | | | Unit | Note |
|---|------------------|-------|------|-------|------|---|
| | | Min. | Typ. | Max. | | |
| LED Light Bar Input Voltage Per Input Pin | V _{PIN} | 33.6 | 37.2 | 40.8 | V | (1) Duty=100%, I _{PIN} =65mA |
| LED Light Bar Current Per Input Pin | I _{PIN} | 0 | 65 | 70 | mA | (1) (2) Duty=100% |
| LED Life Time | L _{LED} | 30000 | — | — | Hrs | (3) |
| Power Consumption | P _{BL} | — | 9.67 | 10.61 | W | (1) Duty=100%, I _{PIN} =65mA |

Note (1) LED light bar input voltage and current are measured by utilizing a true RMS multimeter as shown below:

Note (2) $P_{BL} = I_{PIN} \times V_{PIN} \times (4) \text{ input pins}$

Note (3) The lifetime of LED is defined as the time when LED packages continue to operate under the conditions at $T_a = 25 \pm 2^\circ\text{C}$ and $I = (65)\text{mA}$ (per chip) until the brightness becomes $\leq 50\%$ of its original value.



4. BLOCK DIAGRAM OF INTERFACE**4.1 TFT LCD MODULE**

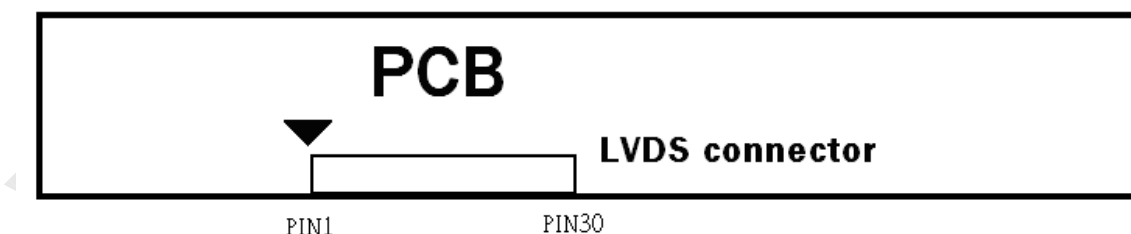
5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD Module Input

| Pin No. | Symbol | Description | Note |
|---------|----------------------------|---------------------------------------|------|
| 1 | NC | No connection | (2) |
| 2 | NC | No connection | (2) |
| 3 | NC | No connection | (2) |
| 4 | GND | Ground | |
| 5 | RX0- | Negative transmission data of pixel 0 | |
| 6 | RX0+ | Positive transmission data of pixel 0 | |
| 7 | GND | Ground | |
| 8 | RX1- | Negative transmission data of pixel 1 | |
| 9 | RX1+ | Positive transmission data of pixel 1 | |
| 10 | GND | Ground | |
| 11 | RX2- | Negative transmission data of pixel 2 | |
| 12 | RX2+ | Positive transmission data of pixel 2 | |
| 13 | GND | Ground | |
| 14 | RXCLK- | Negative of clock | |
| 15 | RXCLK+ | Positive of clock | |
| 16 | GND | Ground | |
| 17 | RX3- | Negative transmission data of pixel 3 | |
| 18 | RX3+ | Positive transmission data of pixel 3 | |
| 19 | GND | Ground | |
| 20 | NC | No connection | (2) |
| 21 | SELLVDS (Default: VESA) | Select LVDS data format | (3) |
| 22 | NC | No connection | (2) |
| 23 | GND | Ground | |
| 24 | GND | Ground | |
| 25 | NC | No connection | (2) |
| 26 | VCC | Power supply: +5V | |
| 27 | VCC | Power supply: +5V | |
| 28 | VCC | Power supply: +5V | |
| 29 | VCC | Power supply: +5V | |
| 30 | VCC | Power supply: +5V | |

Note (1) Connector part no.: P-TWO 187098-30091 or equivalent

LVDS connector pin order defined as follows



Note (2) Reserved for CMI internal use, please leave it open.

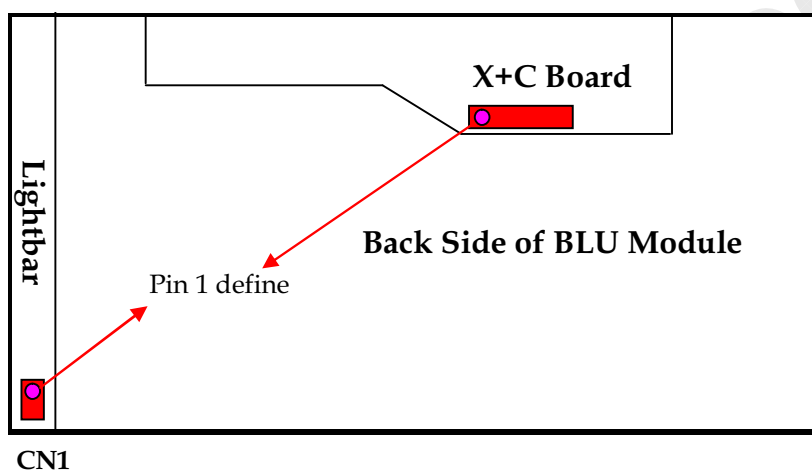
Note (3) Low = Connect to GND: JEIDA Format, High = connect to +3.3V or Open: VESA Format.

Please refer to 5.4 LVDS INTERFACE

5.2 BACKLIGHT UNIT

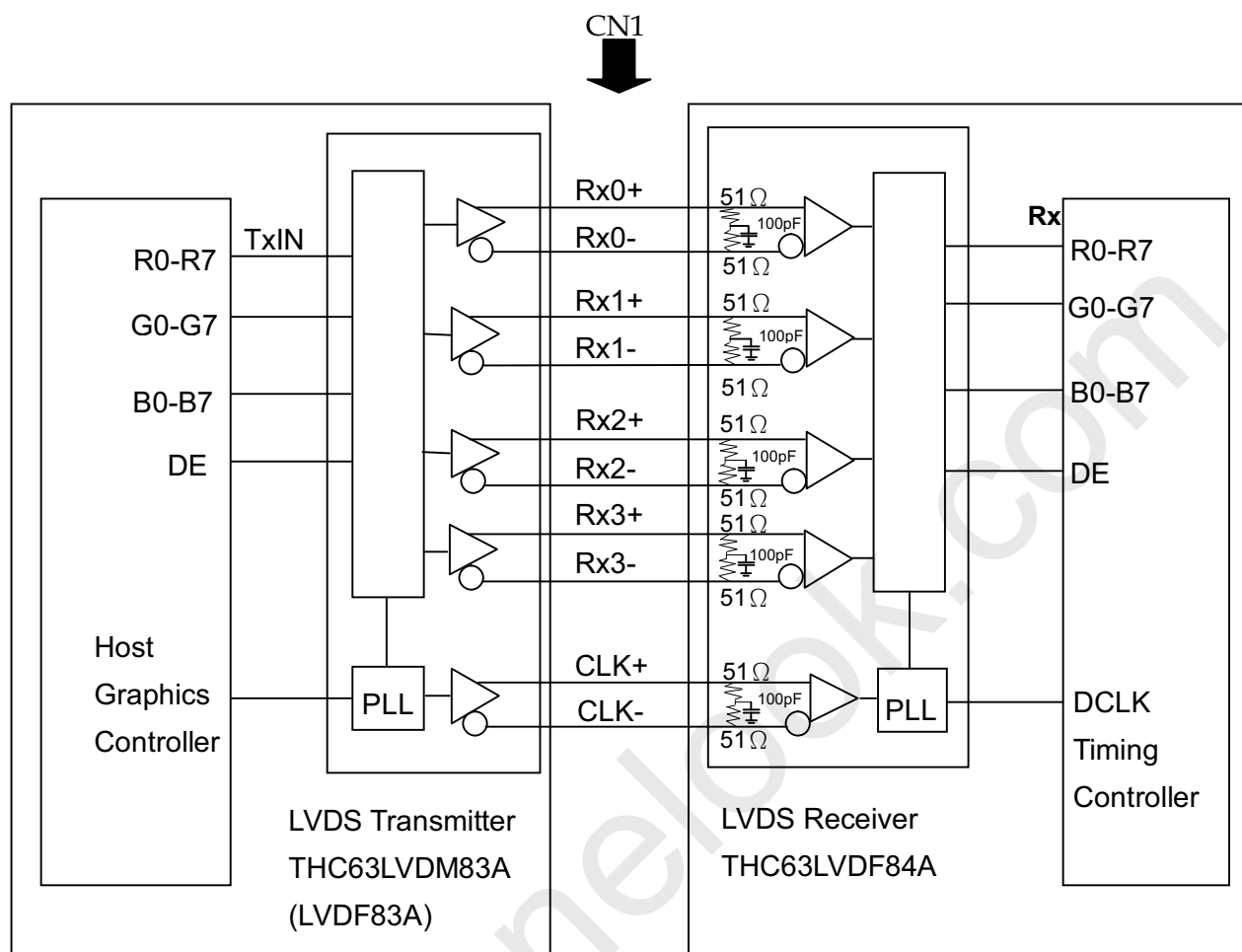
The pin configuration for the housing and the leader wire is shown in the table below.

| CN1 | |
|-----|-----------------------|
| Pin | Description |
| 1 | Cathode of LED string |
| 2 | Cathode of LED string |
| 3 | VLED |
| 4 | VLED |
| 5 | Cathode of LED string |
| 6 | Cathode of LED string |



Lightbar Connector CN1: CviLux, CI1406M1HRJ-NH, or compatible

5.3 BLOCK DIAGRAM OF INTERFACE



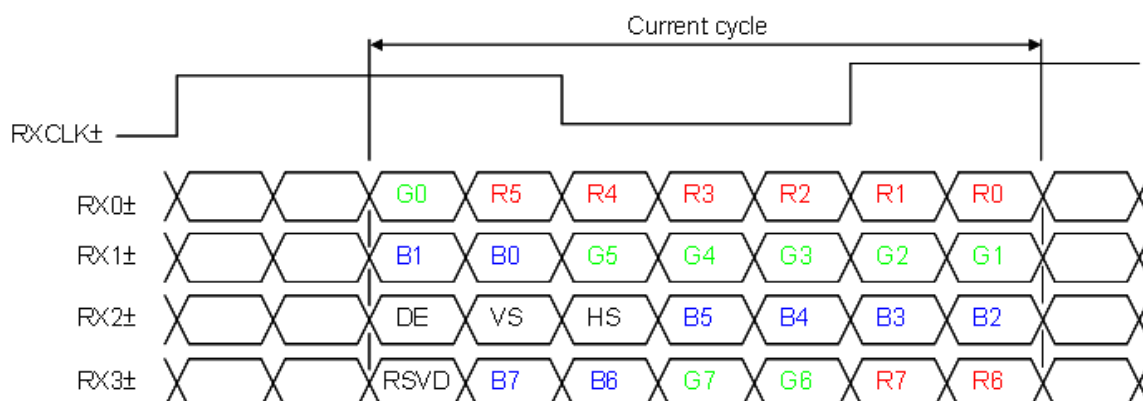
R0~R7 : Pixel R Data
 G0~G7 : Pixel G Data
 B0~B7 : Pixel B Data
 DE : Data enable signal
 DCLK : Data clock signal

Note (1) The system must have the transmitter to drive the module.

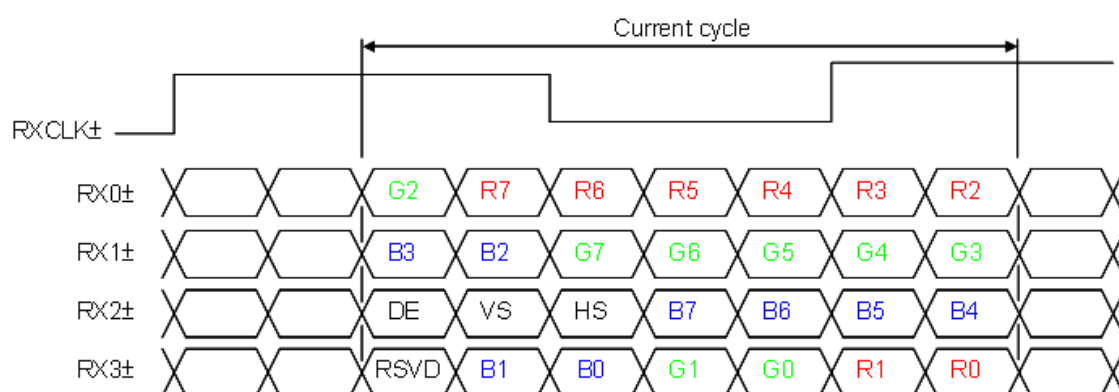
Note (2) LVDS cable impedance shall be 50 ohms per signal line or about 100 ohms per twist-pair line when it is used differentially.

5.4 LVDS INTERFACE

VESA Format: SELLVDS = H or Open



JEIDA Format: SELLVDS = L



R0~R7 : Pixel R Data (7; MSB, 0; LSB)

G0~G7 : Pixel G Data (7; MSB, 0; LSB)

B0~B7 : Pixel B Data (7; MSB, 0; LSB)

DE : Data enable signal

Notes (1) RSVD (reserved) pins on the transmitter shall be "H" or "L" or OPEN

5.5 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of the color versus data input.

| Color | | Data Signal | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------|------------------|-------------|----|----|----|----|----|----|----|-------|----|----|----|----|----|----|----|------|----|----|----|----|----|----|----|
| | | Red | | | | | | | | Green | | | | | | | | Blue | | | | | | | |
| | | R7 | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Colors | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Cyan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Magenta | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Yellow | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | White | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Gray Scale Of Red | Red (0) / Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red (1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red (2) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Red (253) | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red (254) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red (255) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale Of Green | Green (0) / Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green (1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green (2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Green (253) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green (254) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green (255) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale Of Blue | Blue (0) / Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue (1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | Blue (2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Blue (253) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| | Blue (254) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| | Blue (255) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Note (1) 0: Low Level Voltage, 1: High Level Voltage



6. INTERFACE TIMING

6.1 INPUT SIGNAL TIMING SPECIFICATIONS

(Ta = 25 ± 2 °C)

The input signal timing specifications are shown as the following table and timing diagram.

| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|--------------------------------|--------------------------------------|------------------------|-----------------|------|-----------------|------|---------------------|
| LVDS Receiver Clock | Frequency | F_{clkin} (=1/TC) | 60 | 75.4 | 94.3 | MHz | |
| | Input cycle to cycle jitter | T_{rcl} | — | — | 200 | ps | (3) |
| | Spread spectrum modulation range | F_{clkin_mod} | $F_{clkin}-3\%$ | — | $F_{clkin}+3\%$ | MHz | (4) |
| | Spread spectrum modulation frequency | F_{SSM} | — | — | 200 | KHz | |
| LVDS Receiver Data | Setup Time | T_{lvsu} | 600 | — | — | ps | (5) |
| | Hold Time | T_{lvhd} | 600 | — | — | ps | |
| Vertical Active Display Term | Frame Rate | Fr | 47 | 60 | 75 | Hz | |
| | Total | T_v | 778 | 806 | 1050 | Th | $T_v=T_{vd}+T_{vb}$ |
| | Display | T_{vd} | 768 | 768 | 768 | Th | |
| | Blank | T_{vb} | 10 | 38 | 282 | Th | |
| Horizontal Active Display Term | Total | T_h | 1500 | 1560 | 1750 | Tc | $T_h=T_{hd}+T_{hb}$ |
| | Display | T_{hd} | 1366 | 1366 | 1366 | Tc | |
| | Blank | T_{hb} | 134 | 194 | 384 | Tc | |

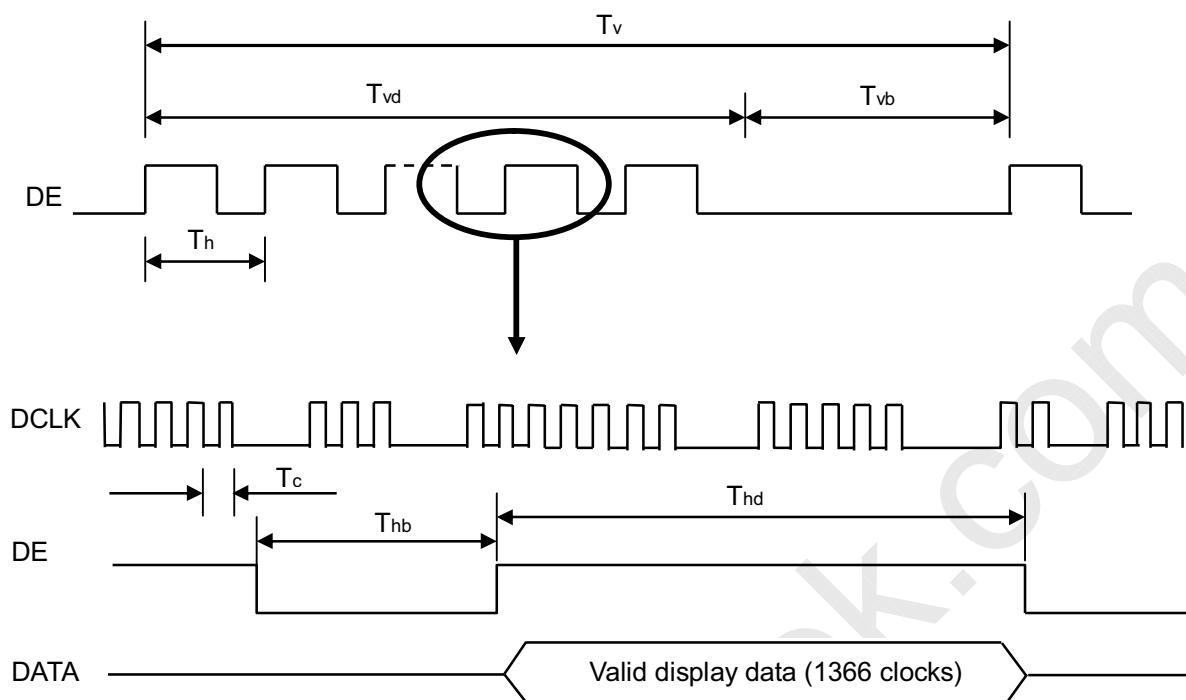
Note (1) Please make sure the range of pixel clock has follow the below equation :

$$F_{clkin}(\max) \geq Fr \times Tv \times Th$$

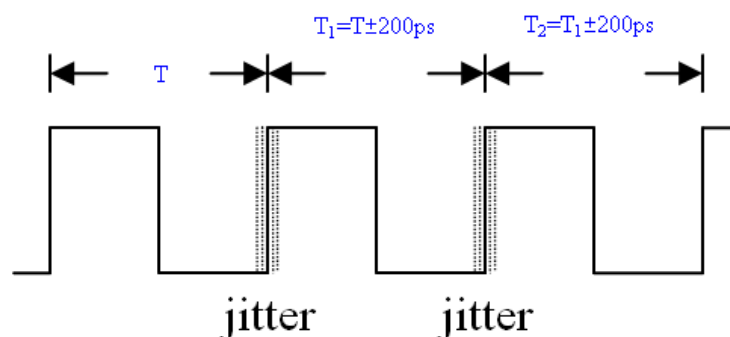
$$Fr \times Tv \times Th \geq F_{clkin}(\min)$$

Note (2) This module is operated in DE only mode and please follow the input signal timing diagram below :

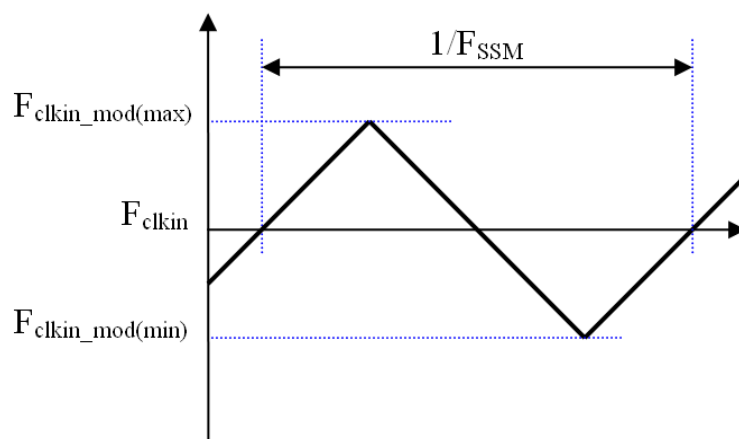
INPUT SIGNAL TIMING DIAGRAM



Note (3) The input clock cycle-to-cycle jitter is defined as below figures. $Trcl = |T_1 - T_2|$

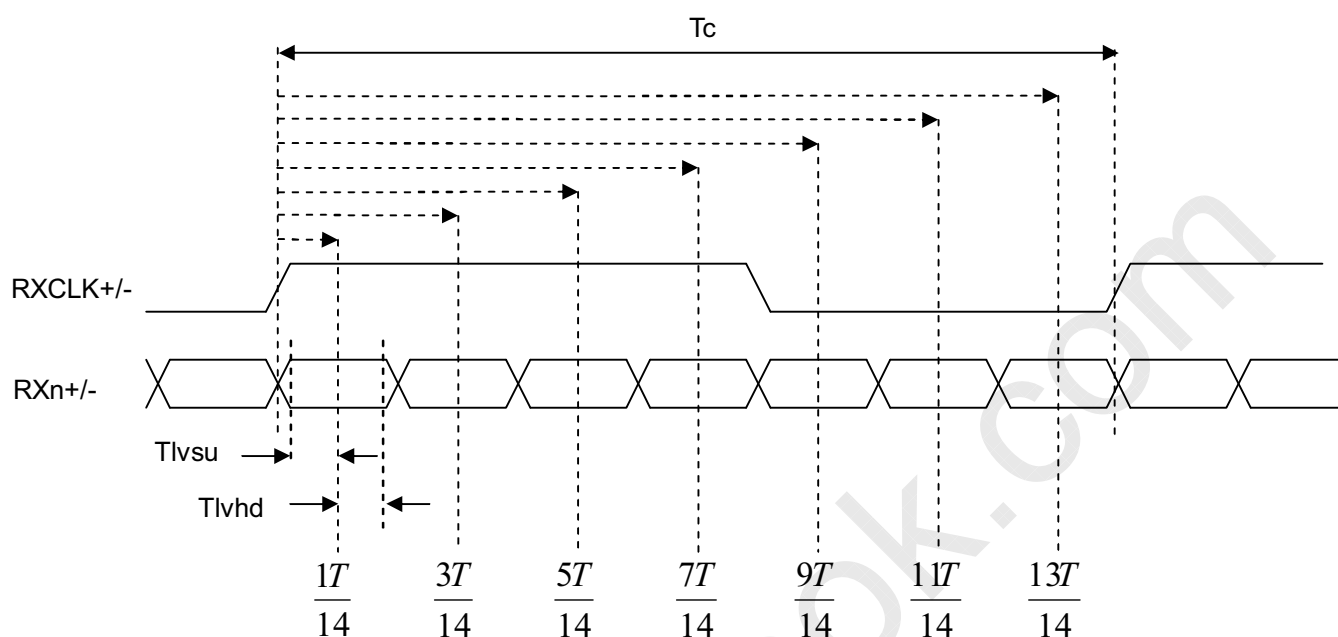


Note (4) The SSCG (Spread spectrum clock generator) is defined as below figures.



Note (5) The LVDS timing diagram and setup/hold time is defined and showing as the following figures.

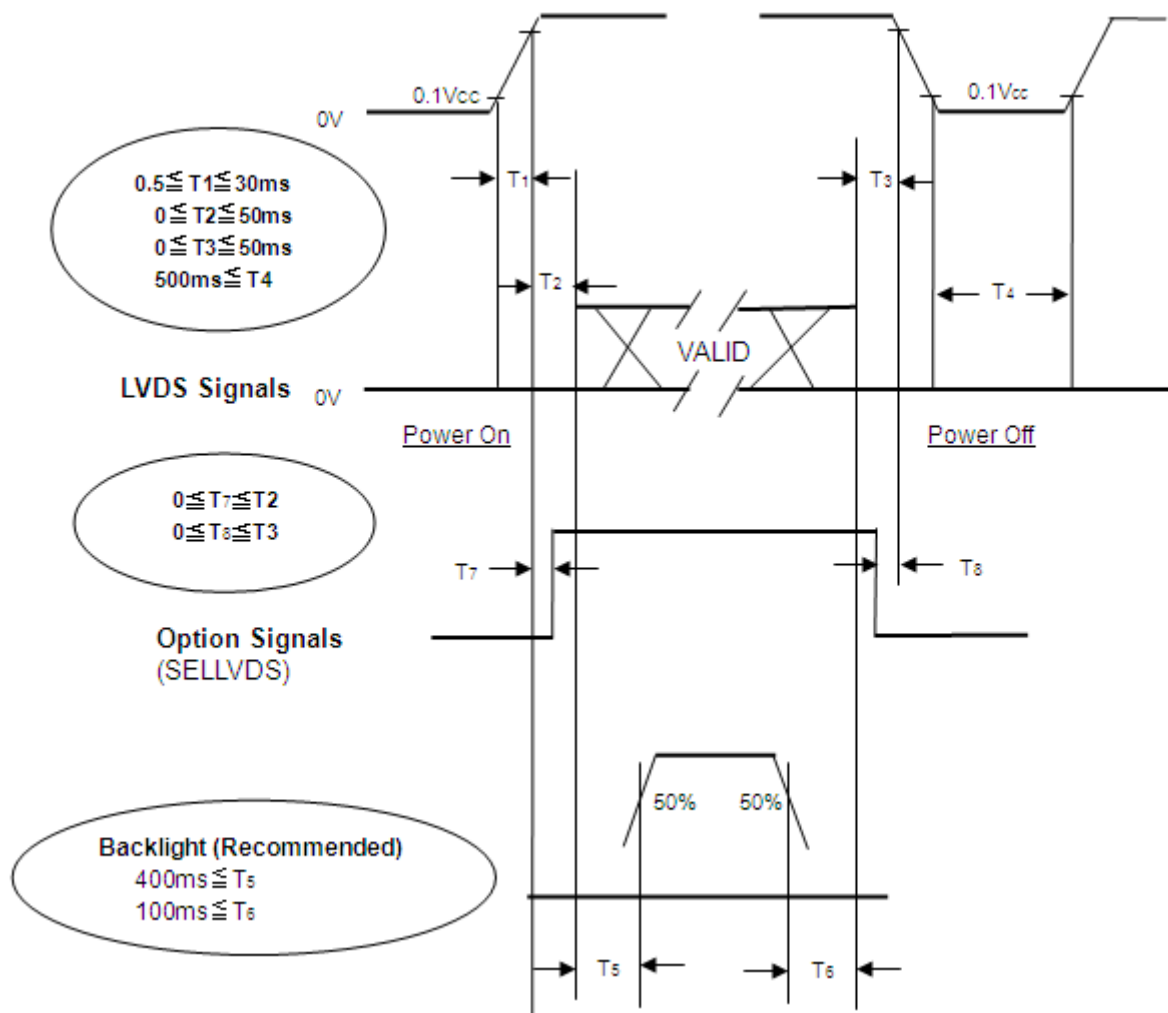
LVDS RECEIVER INTERFACE TIMING DIAGRAM



6.2 POWER ON/OFF SEQUENCE

($T_a = 25 \pm 2^\circ\text{C}$)

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should be as the diagram below.



Note (1) The supply voltage of the external system for the module input should follow the definition of Vcc.

Note (2) Apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.

Note (3) In case of Vcc is in off level, please keep the level of input signals on the low or high impedance. If $T_2 < 0$, that maybe cause electrical overstress failure.

Note (4) T_4 should be measured after the module has been fully discharged between power off and on period.

Note (5) Interface signal shall not be kept at high impedance when the power is on.

**7. OPTICAL CHARACTERISTICS****7.1 TEST CONDITIONS**

| Item | Symbol | Value | Unit |
|---|---|-----------|------------------|
| Ambient Temperature | Ta | 25 ± 2 | ℃ |
| Ambient Humidity | Ha | 50 ± 10 | %RH |
| Supply Voltage | V _{CC} | 5.0 | V |
| Input Signal | According to typical value in "3. ELECTRICAL CHARACTERISTICS" | | |
| LED Light Bar Input Current Per Input Pin | I _{PIN} | 65 ± 1.95 | mA _{DC} |
| PWM Duty Ratio | D | 100 | % |
| LED Light Bar Test Converter | CMI 35-D065452 + Transfer board | | |

The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 1 hour in a windless room.

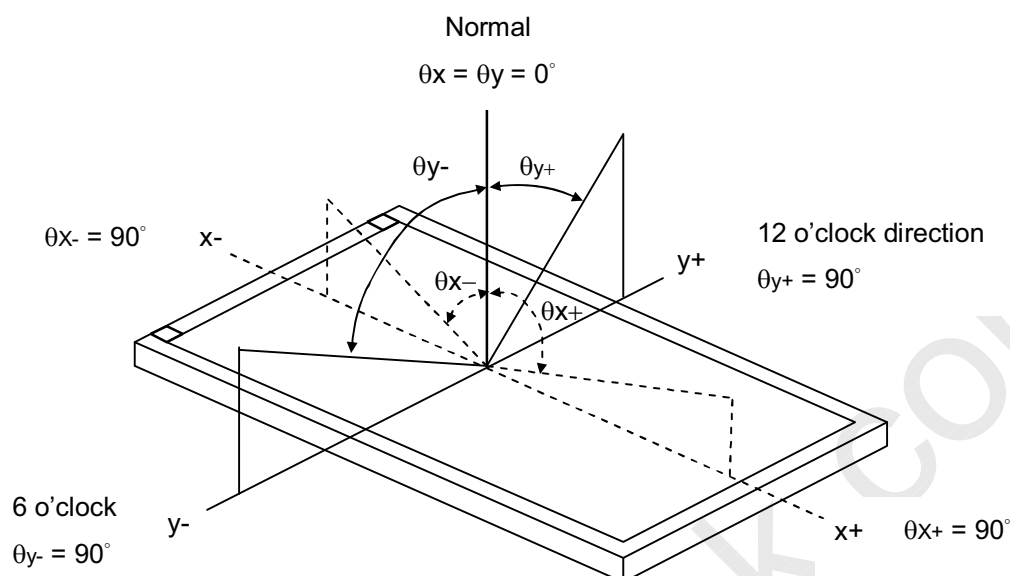
7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in 7.1.

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---------------------------|-------------|-----------------------------|--|---------------|-------|---------------|-------------------|------------|
| Contrast Ratio | | CR | $\theta_x=0^\circ, \theta_y=0^\circ$ Viewing angle at normal direction | 700 | 1000 | — | | (2) |
| Response Time | | T_R | | — | 1.3 | 2.2 | ms | (3) |
| | | T_F | | — | 3.7 | 16 | | |
| Center Luminance of White | | L_C | | 200 | 250 | — | cd/m ² | (4) |
| White Variation | | δW | | — | — | 1.3 | | (7) |
| Cross Talk | | CT | | — | — | 4 | % | (5) |
| Color Chromaticity | Red | R_x | | Typ. -0.03 | 0.641 | Typ. +0.03 | | (6) |
| | | R_y | | | 0.338 | | | |
| | Green | G_x | | | 0.304 | | | |
| | | G_y | | | 0.620 | | | |
| | Blue | B_x | | | 0.153 | | | |
| | | B_y | | | 0.051 | | | |
| | White | W_x | | | 0.282 | | | |
| | | W_y | | | 0.290 | | | |
| | Color Gamut | CG | | — | 72 | — | % | NTSC Ratio |
| Viewing Angle | Horizontal | $\theta_{x+} + \theta_{x-}$ | CR>10 | 150 | 170 | — | Deg. | (1) (6) |
| | Vertical | $\theta_{y+} + \theta_{y-}$ | | 140 | 160 | — | | |
| | Horizontal | $\theta_{x+} + \theta_{x-}$ | CR>5 | 160 | 178 | — | | |
| | Vertical | $\theta_{y+} + \theta_{y-}$ | | 150 | 170 | — | | |

Note (1) Definition of Viewing Angle (θ_x , θ_y):

Viewing angles are measured by Autronic Conoscope Cono-80



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

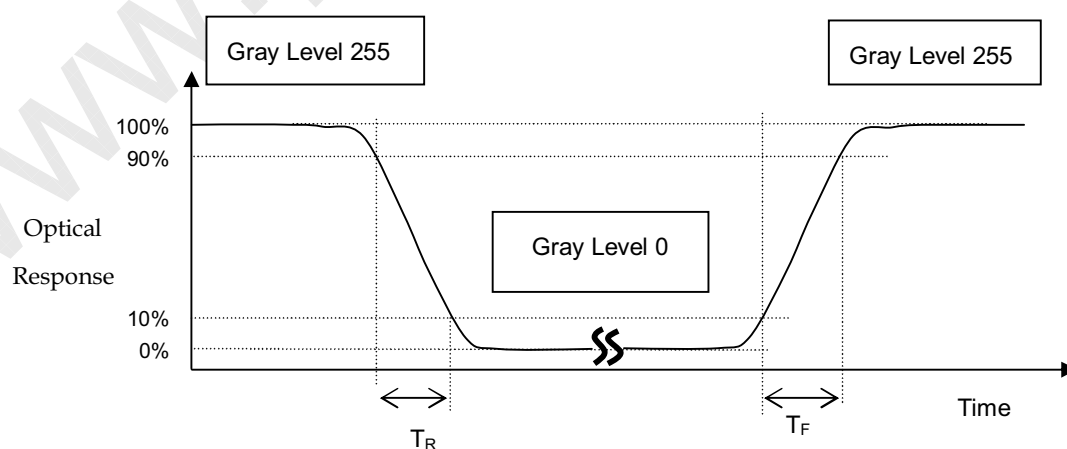
L_{255} : Luminance of gray level 255

L_0 : Luminance of gray level 0

$$CR = CR(5),$$

$CR(X)$ is corresponding to the Contrast Ratio of the point X at the figure in Note (7).

Note (3) Definition of Response Time (T_R , T_F):



Note (4) Definition of Luminance of White (L_C):

Measure the luminance of gray level 255 at center point and 5 points

$$L_C = L(5)$$

$L(X)$ is corresponding to the luminance of the point X at the figure in Note (7).

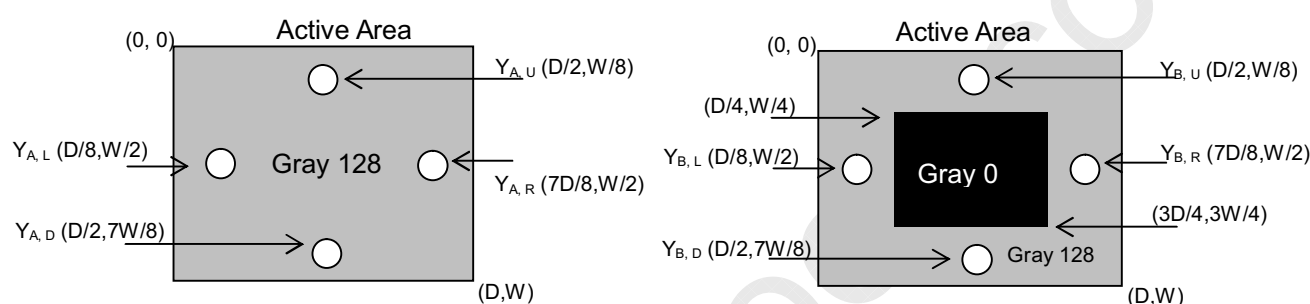
Note (5) Definition of Cross Talk (CT):

$$CT = |Y_B - Y_A| / Y_A \times 100 (\%)$$

Where:

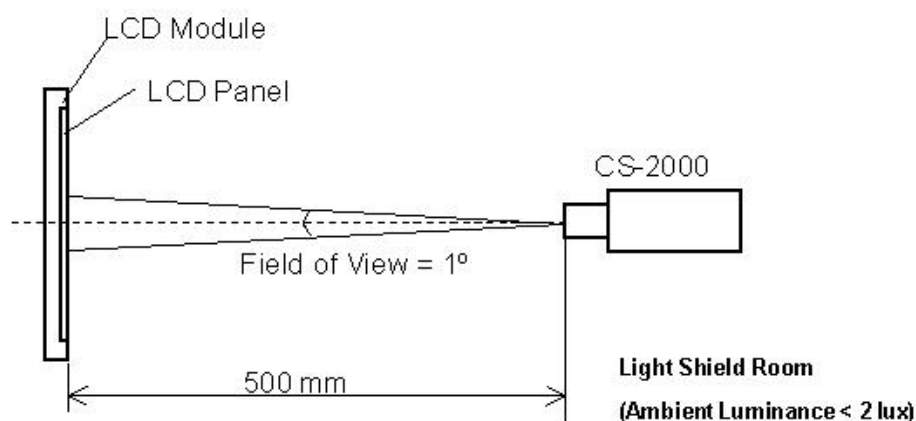
Y_A = Luminance of measured location without gray level 0 pattern (cd/m^2)

Y_B = Luminance of measured location with gray level 0 pattern (cd/m^2)



Note (6) Measurement Setup:

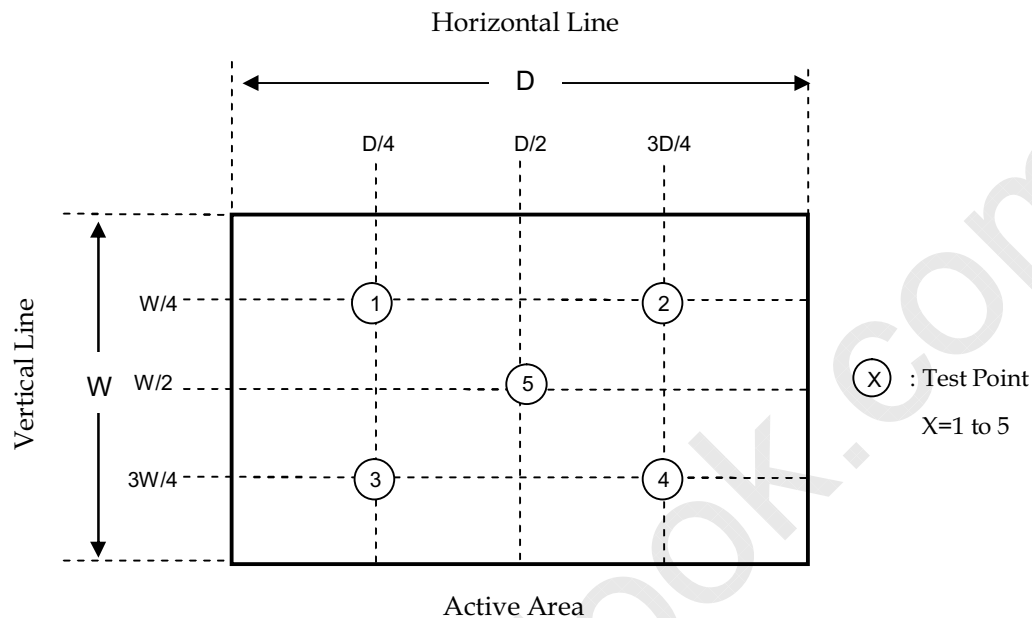
The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 1 hour in a windless room.



Note (7) Definition of White Variation (δW):

Measure the luminance of gray level 255 at 5 points

$$\delta W = \text{Maximum [L (1), L (2), L (3), L (4), L (5)]} / \text{Minimum [L (1), L (2), L (3), L (4), L (5)]}$$



8. PRECAUTIONS

8.1 ASSEMBLY AND HANDLING PRECAUTIONS

- [1] Do not apply rough force such as bending or twisting to the module during assembly.
- [2] It is recommended to assemble or to install a module into the user's system in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- [3] Do not apply pressure or impulse to the module to prevent the damage of LCD panel and Backlight.
- [4] Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.
- [5] Do not plug in or pull out the I/F connector while the module is in operation.
- [6] Do not disassemble the module.
- [7] Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- [8] Moisture can easily penetrate into LCD module and may cause the damage during operation.
- [9] When storing modules as spares for a long time, the following precaution is necessary.
 - [9.1] Do not leave the module in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35°C at normal humidity without condensation.
 - [9.2] The module shall be stored in dark place. Do not store the TFT-LCD module in direct sunlight or fluorescent light.
- [10] When ambient temperature is lower than 10°C, the display quality might be reduced. For example, the response time will become slow.

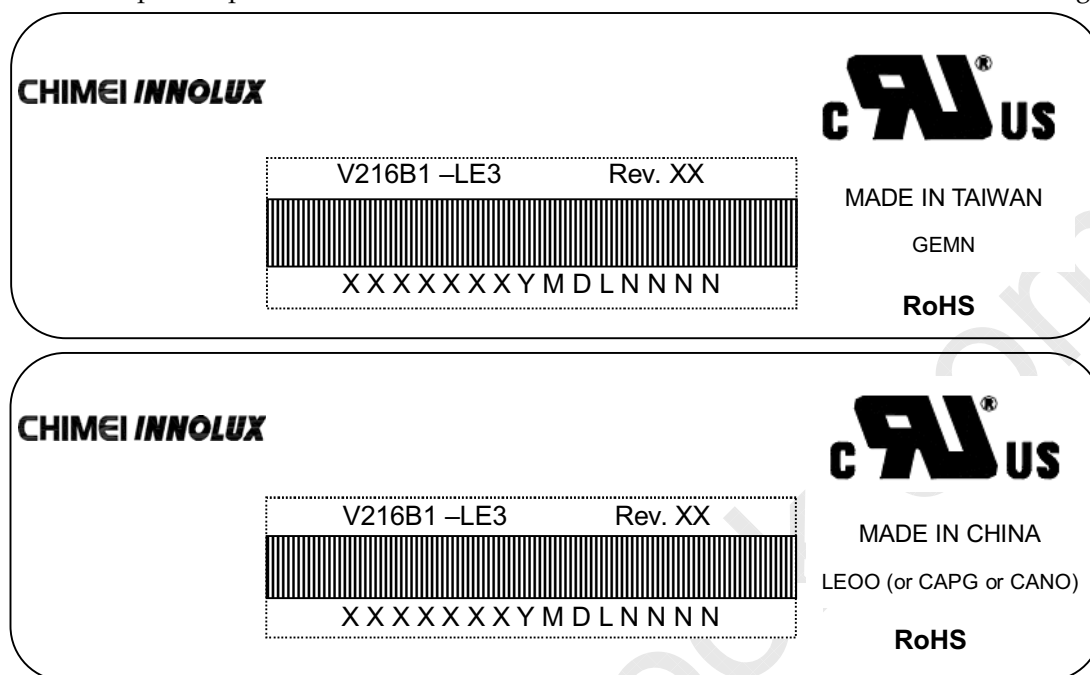
8.2 SAFETY PRECAUTIONS

- [1] If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- [2] After the module's end of life, it is not harmful in case of normal operation and storage.

9. DEFINITION OF LABELS

9.1 CMI MODULE LABEL

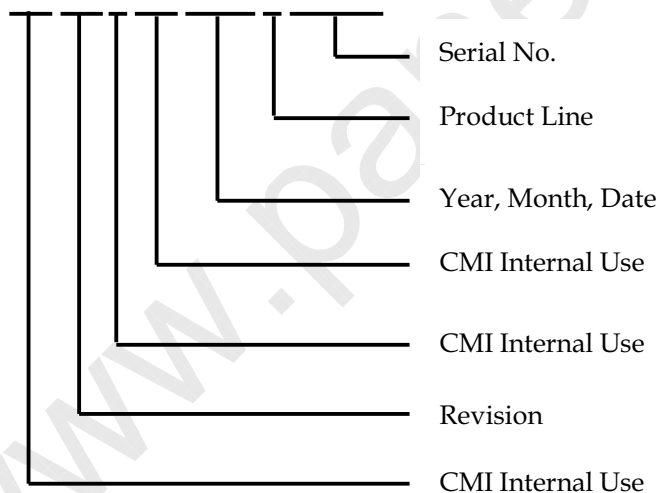
The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



Model Name: V216B1-LE3

Revision: Rev. XX, for example: A0, A1... B1, B2... or C1, C2...etc.

Serial ID: XXXXXXXXYMDLNNNN



Serial ID includes the information as below:

Manufactured Date:

Year: 2001=1, 2002=2, 2003=3, 2004=4...2010=0, 2011=1, 2012=2...

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1st to 31st, exclude I, O, and U.

Revision Code: Cover all the change

Serial No.: Manufacturing sequence of product

Product Line: 1 → Line1, 2 → Line 2, ...etc.

10. PACKAGING

10.1 PACKAGING SPECIFICATIONS

- (1) 15 LCD TV modules / 1 Box
- (2) Box dimensions : 563(L) x 417(W) x 375(H)mm
- (3) Weight : approximately 33Kg(15 modules per box)

10.2 PACKAGING METHOD

Figures 10-1 and 10-2 are the packing method

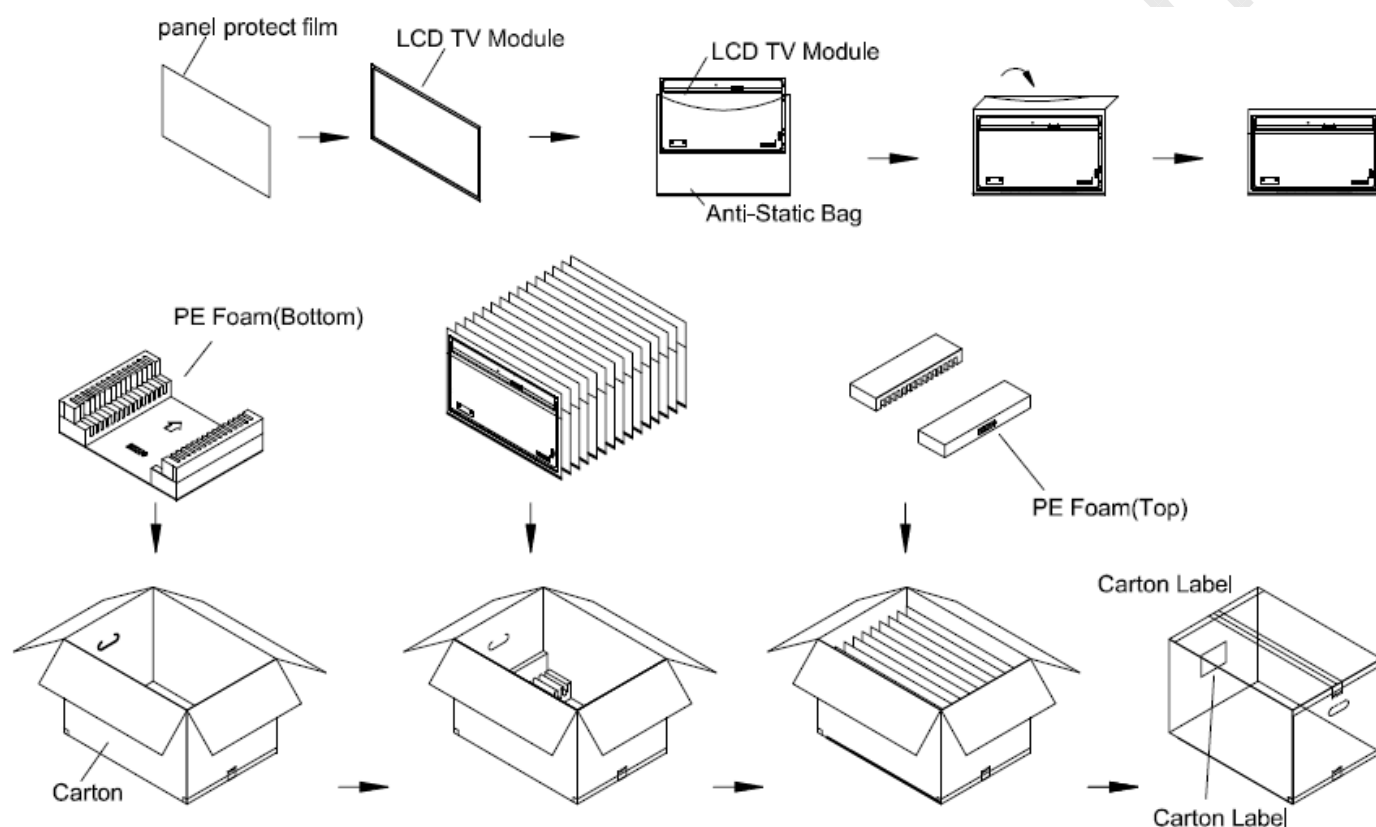
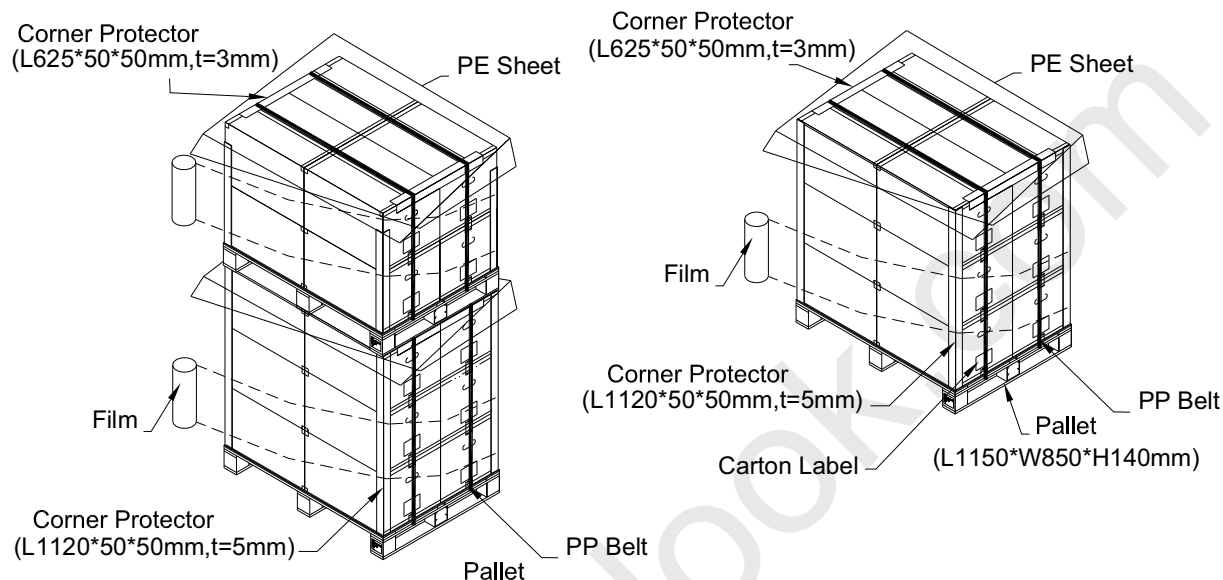


Figure 10-1 packing method



Sea / Land Transportation (40ft Container)

Air Transportation



Sea / Land Transportation (40ft HQ Container)

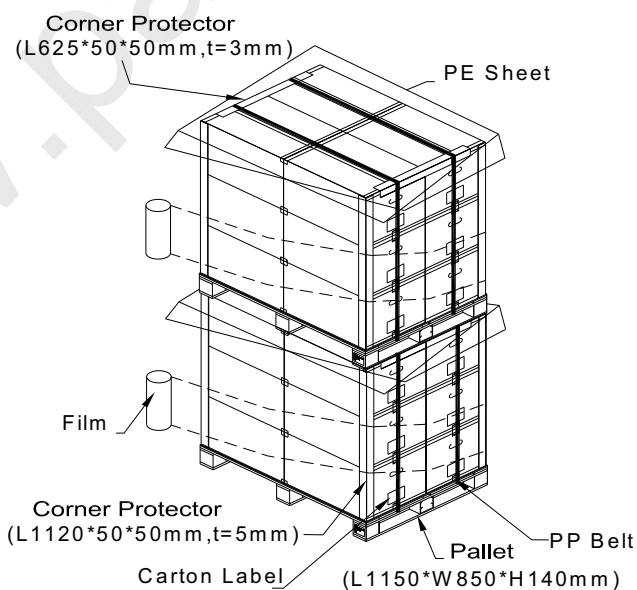


Figure 10-2 packing method

11. MECHANICAL CHARACTERISTIC

